

MicroStation GeoGraphics (Beta 3.0) Evaluation

by

Robin J. Hoban¹, Hong-lie Qiu²
Kathy Riegelmann³ and Jim Hoff

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Spatial Data Analysis Center, Coastal Engineering Research Center, USACE, Waterways Experiment Station.

Remote Sensing and Image Processing Laboratory, Louisiana State University, Baton Rouge, LA.

Tri-Service CADD/GIS Technology Center, USACE, Waterways Experiment Station.

Introduction

A software functionality evaluation of MicroStation GeoGraphics, a registered trademark of Bentley Systems, Inc., was conducted by the Spatial Data Analysis Center of the Coastal Engineering Research Center and the Tri-Service CADD/GIS Technology Center at the US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. MicroStation GeoGraphics was designed as a toolbox for mapping and GIS applications and runs in conjunction with MicroStation 95. This evaluation consists of an overview of critical GIS tools and functions and a comparison of MicroStation GeoGraphics to Intergraph Corporation's suite of Modular GIS Environment (MGE) products as well as Environmental Systems Research Institute's (ESRI), Inc., line of GIS tools and functions. The list price of MicroStation GeoGraphics is \$1,650. With the purchase of MicroStation 95 and MicroStation GeoGraphics, the list price is \$5,325. Sites running versions of MicroStation, other than MicroStation 95, can upgrade to MicroStation 95 with MicroStation GeoGraphics for \$1,995. On 22 February 1996 the Tri-Service Center requested that Intergraph Corporation take action to include MicroStation GeoGraphics on their CAD-2 contract.

Software Type

GeoGraphics is designed as a comparatively low-cost GIS tool that is a seamless extension to the MicroStation computer-aided design (CAD) package. While MicroStation GeoGraphics delivers this CAD/GIS integration which can be used for facilities management, automated and desktop mapping, database management, and image handling, it does not contain the more robust features and capabilities of the individual MGE modules and ARC/INFO tools designed specifically for those complex tasks.

Operating Systems and Requirements

MicroStation GeoGraphics requires the use of MicroStation 95 and will soon run on CLIX, Sun Solaris, and HP/UX. Bentley, Inc., also plans to release MicroStation Geographics on DEC Alpha NT, OS/2, and PowerMAC, which are comparable to those supported by Intergraph Corp. for its MGE applications. ESRI's ARC/INFO and ArcView applications currently run on a variety of UNIX platforms. The Windows NT version of ARC/INFO is currently in the beta testing phase and should be released in the summer of 1996. While MGE and ARC/INFO requirements depend on individual modules selected for specific uses, MicroStation GeoGraphics is a desktop tool that requires a fraction of the software investment for certain-like functionalities. However, MGE and ARC/INFO are full functional GIS packages and their capabilities exceed those of MicroStation GeoGraphics at this time. As an emerging product, new functionalities will continue to be developed.

Data Structures

MicroStation GeoGraphics manages both vector and raster data. TIN and advanced 3-D modeling capabilities are not built into MicroStation GeoGraphics and are more completely supported by the appropriate MGE and ARC/INFO modules. Complex spatial and statistical analyses, as well as conversion and manipulation of raster data, are more comprehensively performed by MGE Grid Analyst (MGGA) and the ARC/INFO GRID and TIN modules.

MicroStation GeoGraphics is designed as an integration platform and an end-user environment. The intent is to provide end-users, consultants, and third-party developers with a set of tools that will allow them to build applications. It is not the intent to develop vertical applications at Bentley, Inc. The role is to provide the platform technologies that will allow different applications to share the same foundation and benefit from improved compatibility. To date, Bentley has over 50 third-party developers who are committed to building vertical applications on MicroStation GeoGraphics including photogrammetry, municipal mapping, utilities, environmental, mining, and exploration.

In the area of TIN and 3-D modeling, there are applications that are available from a variety of developers including Terrasolid, Mizar, Geopak, and GWN. Bentley, Inc., is currently looking for developers to create a raster-based analysis tool.

Image processing, Digitizing, and Geographic Coordinate Systems

A subset to the full-functioning image processing tool designed by Descartes is included in MicroStation GeoGraphics. This feature, Image Manager, has the ability to import, export, manage, display, and plot large image files but only in a limited number of formats. These include HMR (Descartes tiled TIFF format), COT and CIT (standard Intergraph formats), and TIFF (standard CAD/GIS format). Once imported, all images are converted to Descartes HMR format.

While the built-in feature adequately manages registered images, additional pre-processing software is necessary to convert, edit, transform, mosaic, and geo-reference (warp) images. The full-featured Descartes product is available as a separate module and is comparable to MGE Base Imager and ARC/INFO's Image Integrator. Without the additional software, Image Manager has serious limitations.

MicroStation GeoGraphics does, however, provide a simple tool for saving images into a separate image project file associated with a MicroStation GeoGraphics project. This tool is a convenient and time-saving advantage over MGE. At the time of the evaluation of the Beta 3.0 release, problems were encountered with raster/vector plotting capabilities within MicroStation GeoGraphics; to what extent hybrid plotting functionality is improved for the final release is a critical issue.

MicroStation GeoGraphics has been designed to be used with the MicroStation Descartes products. Bentley, Inc.'s, intent is to provide Image Manager as a data utilization tool. It is often the case that a core group of users will focus on image preparation and manipulation while the rest of the organization uses these images as reference information to other activities.

Both MicroStation GeoGraphics and MGE are based on MicroStation as the CAD foundation to their GIS products; and, therefore, use the same technologies for data entry, digitizing, and data importation. In general, MicroStation's graphic user interface (GUI), user customization tools, and MDL programming capabilities continue to provide strong functionality. ARC/INFO provides similar application development through AML (Arc Macro Language), as well as GUI development, using FormEdit and ArcTools. ArcTools simplifies common operations such as mapping, query, data automation, and analysis. These functions are carried out using a series of AML-based tools and menus and can be custom designed to meet the specific needs of the user.

The Bentley, Inc., MicroStation GeoGraphics team have used MGE extensively. Many have felt that the MGE product line did not offer much in the way of customization tools which are often necessary in a typical mapping project. MicroStation GeoGraphics has been designed from the ground up as a development environment, providing customization capabilities to a range of users through Bentley, Inc.'s, interface customization tools, macro record/playback, MicroStation BASIC, OLE and DDE integration, and Bentley, Inc.'s, full MDL library that provides programmatic access to most of the major mapping-specific functions included in MicroStation GeoGraphics. As far as Bentley, Inc., is aware, comparable functionality does not exist in the MGE product. Bentley, Inc., views MicroStation GeoGraphics' customization capabilities to be a significant benefit to the user.

MicroStation and MicroStation GeoGraphics do not provide projection management capabilities per se, and a stand-alone application to do these tasks would be necessary if coordinate system conversion and transformation functions are demanded by the project. MGE Projection Manager (MSPM) is a powerful tool for projects that need to incorporate and integrate data from a wide variety of sources using different projections and coordinate systems, as is frequently required. A variety of third party projection/map coordinate system tools are available through Candata, ABAKOS, and Dereck Hunter and Associates. Mizar Systems in Vancouver is developing MicroCoordinator (due to be available in July 1996) that is the equivalent to Intergraph Corp.'s Projection Manager. This product will have a list price of \$800 US. Bentley, Inc., also plans to include coordinate system setup tools in subsequent releases of MicroStation GeoGraphics. Within the standard ARC/INFO package, projection management and coordinate system setup tools exist without the use of an extended module.

Database Operations

At the time of the Beta 3.0 release, MicroStation GeoGraphics supports numerous database packages but not on all platforms. This is expected to improve as MicroStation continues database development. While MGE requires the use of additional software to connect and interface with the chosen database application, MicroStation GeoGraphics takes advantage of

Microsoft's Open Database Connectivity (ODBC) technology. This increases ease of use and simplifies database integration for those supported programs. It should be noted that Bentley, Inc., also supports Intergraph's RIS (Relational Interface System). Within ARC/INFO's standard module, Database Integrator allows for connections to external database management systems.

Topology and Spatial Analysis

Most of the functionality found in MGE Analyst (MGA) is available in MicroStation GeoGraphics. Instead of relying on persistent topographic files for spatial query and map creation as MGA does, MicroStation GeoGraphics provides tools for creating topological relationships on-the-fly which ensures that data (both the geometry and database attributes) are never outdated. Spatial queries and map creation can be performed interactively. This makes the tools easier to use and simplifies the task of topology management over MGA's work flow. ARC/INFO is built upon topological functionality. The ability to perform spatial and analytical queries and to create maps based on those results is part of the overall ARC/INFO package.

Map Creation

Map creation based on database attributes and/or spatial relationships is easier to use in MicroStation GeoGraphics. It has a rich set of functions for automatic data classification, legend generation, resymbolization, area filling, patterning, and text label creation from database information. The menu-driven nature of these functions makes the software easy to use for the operator without extensive training in CAD and GIS. The Thematic Resymbolization tool rates highly for ease of use, but speed on display is comparatively slow and is not acceptable for high-speed presentations.

MDL Toolkit for Implementing Specialized GIS Functions

MicroStation GeoGraphics is mostly implemented by the MicroStation Development Language (MDL), an interpreted language. The availability of extensive MDL program libraries related to GIS activities (through Bentley and third-party sources) and further application-specific MDL customization (by users) makes MicroStation GeoGraphics an open-development platform which will continue to expand its functionality.

Since version 4.2 on UNIX and version 5 on PC, Bentley, Inc., has supported dynamic link modules (DLMs). DLM's allow MDL developers to compile their applications in machine-compiled code for performance-sensitive operations. MicroStation GeoGraphics makes extensive use of DLMs, especially in the feature-based display and topology analysis tools. If the DLM's are not used, the MDL programs are interpreted and converted into machine codes by the MicroStation MDL Interpreter during execution. This extra step unavoidably affects the performance of the program. Because of this limitation, it may not be acceptable for applications that require a lot of interactive presentation and do not utilize DLM's. Often, those customized enhancements are already available in the more sophisticated MGE product line.

Conclusion

Like the suite of MGE products, MicroStation GeoGraphics is a general purpose CAD/GIS tool box. It is new, however, and does not at this time contain all the functionalities delivered in the MGE suite (e.g. Projection Manager, Terrain Modeler, Grid Analyst, Base Imager, and others) and ARC/INFO modules (e.g. GRID, TIN, IMAGE INTEGRATOR, Projection management functions, etc). This situation will soon change because (1) third-party vendors are developing specialized modules to complement or enhance the functionality of MicroStation GeoGraphics and (2) there are many MDL functions that give developers full access to the underlying graphics, database attributes, and spatial processing power for implementing custom functionalities.

MicroStation GeoGraphics is an efficient tool for adding additional database functionality to the existing MicroStation CAD environment, but by itself does not presently replace the advanced features of other more sophisticated GIS packages for large-scale mapping and GIS applications. MicroStation GeoGraphic's projects are compatible with MGE, and the ability to read and write those files makes MicroStation GeoGraphics a viable supplement to the larger system. MicroStation GeoGraphics does offer cost savings, portability, much less user training, faster product implementation, and the promise of future development. But when compared to Intergraph's MGE and ARC/INFO's product line, MicroStation GeoGraphics has yet to become as complete a GIS package as is needed for the more demanding GIS projects.